

LEE -- 10/730,941
Attorney Docket: 021906-0306952

REMARKS

Claims 1-12 are pending. By this Amendment, claims 1-7 are amended. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Claim 3 was objected to. Claim 3 has been amended to obviate the objection. Reconsideration and withdrawal of the objection are respectfully requested.

Claims 1, 2 and 7 were rejected under 35 U.S.C. § 102(a) over Kim (U.S. Patent Application Publication 2002/018567 A1) and claim 3 was rejected under 35 U.S.C. § 103(a) over Kim. The rejections are respectfully traversed.

MPEP § 2131 states:

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). "The elements must be arranged as required by the claim, but this is not an *ipsisimilis verbis* test, i.e., identity of terminology is not required." *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

Claim 1 recites a barrier structure for copper metallization, including a dielectric pattern formed on a surface of a substrate; a first Ru layer formed on the dielectric pattern; an oxide film formed by oxidizing an upper part of the first Ru layer; a second Ru layer formed on the oxide film; and a Cu layer formed on the second Ru layer.

Cu is widely used as a metallization material because it has lower electrical resistivity and higher conductivity. However, Cu has a problem that Cu readily diffuses into nearly all materials used in Si devices, causing degrading of characteristics of the devices. Accordingly, the invention of claim 1 provides a Cu metallization structure with an improved diffusion barrier as a three layer structure.

In contrast, Kim discloses a metal insulator metal(MIM) capacitor on the same level with a dual damascene Cu line. Since the three layers structure of Kim relates to a MIM capacitor, the apparatus of Kim is clearly different from that of the invention of claim 1. In particular, in Kim an oxide layer is an insulator formed by using CVD, PVD or ALD or the like, whereas the oxide film of claim 1 is formed by oxidizing the upper part of the first Ru layer. The oxide film

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of claim 1 is Ru oxide and Ru oxide has a high electric conductivity. Therefore, Kim does not disclose an oxide film according to claim 1.

Claims 2 and 3 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claim 1 and for the additional features recited therein.

Claim 7 is allowable over Kim because Kim does not disclose or suggest forming an oxide film in a surface region of the first Ru layer.

Reconsideration and withdrawal of the rejections over Kim are respectfully requested.

Claims 1, 2, 4 and 7 were rejected under 35 U.S.C. § 102(e) over Callegari et al. (U.S. Patent 6,664,186 and claim 6 was rejected under 35 U.S.C. § 103(a) over Callegari et al. in view of Zurcher et al. (U.S. Patent 6,344,413). The rejections are respectfully traversed.

Callegari et al. disclose a method of depositing aluminum oxide films. The embodiment cited by the Examiner (Fig. 28 and Example 9 in the description) relates to an integrated circuit trench capacitor. Moreover, in Callegari et al., a dielectric layer 34 is inserted between a bottom electrode 33 and a top electrode 35, whereas such a dielectric layer is not included in the barrier structure of claims 1 and 7. Accordingly, the apparatus fabricated by the method of Callegari et al. cannot anticipate or render obvious claims 1 and 7.

Claims 2, 4, and 6 recite additional features of the invention and are allowable for the same reasons as discussed above with respect to claim 1. In addition, it is respectfully submitted that Zurcher et al. fail to cure the deficiencies of Callegari et al. with respect to claim 1 and that even assuming it would have been obvious, which Applicant does not concede, such a combination would not result in the claimed invention.

Reconsideration and withdrawal of the rejections over Callegari et al. and Callegari et al. in view of Zurcher et al. are respectfully requested. Rejoinder and allowance of withdrawn claims 8-12 are also respectfully requested.

In view of the above amendments and remarks, Applicant respectfully submits that all of the claims are allowable and that the entire application is condition for allowance.

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Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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